# Section 7
# Distribution Facilities Design and Construction Standards

This section of the 2001 Water System Plan (WSP) describes the standards and procedures followed by SPU in the installation of new water mains and the interior coating of water storage facilities. These requirements are intended to meet or exceed the design and construction standards referenced in WAC 246-290. Together with the City of Seattle's Standard Specifications (Seattle, 2000a) and Standard Plans (Seattle, 2000b), this material is intended to meet the requirements of the DOH submittal exception process for distribution main construction and tank painting. By qualifying for this process and following the approved procedures and standards, SPU is provided a waiver from the requirement of DOH approval of individual projects.

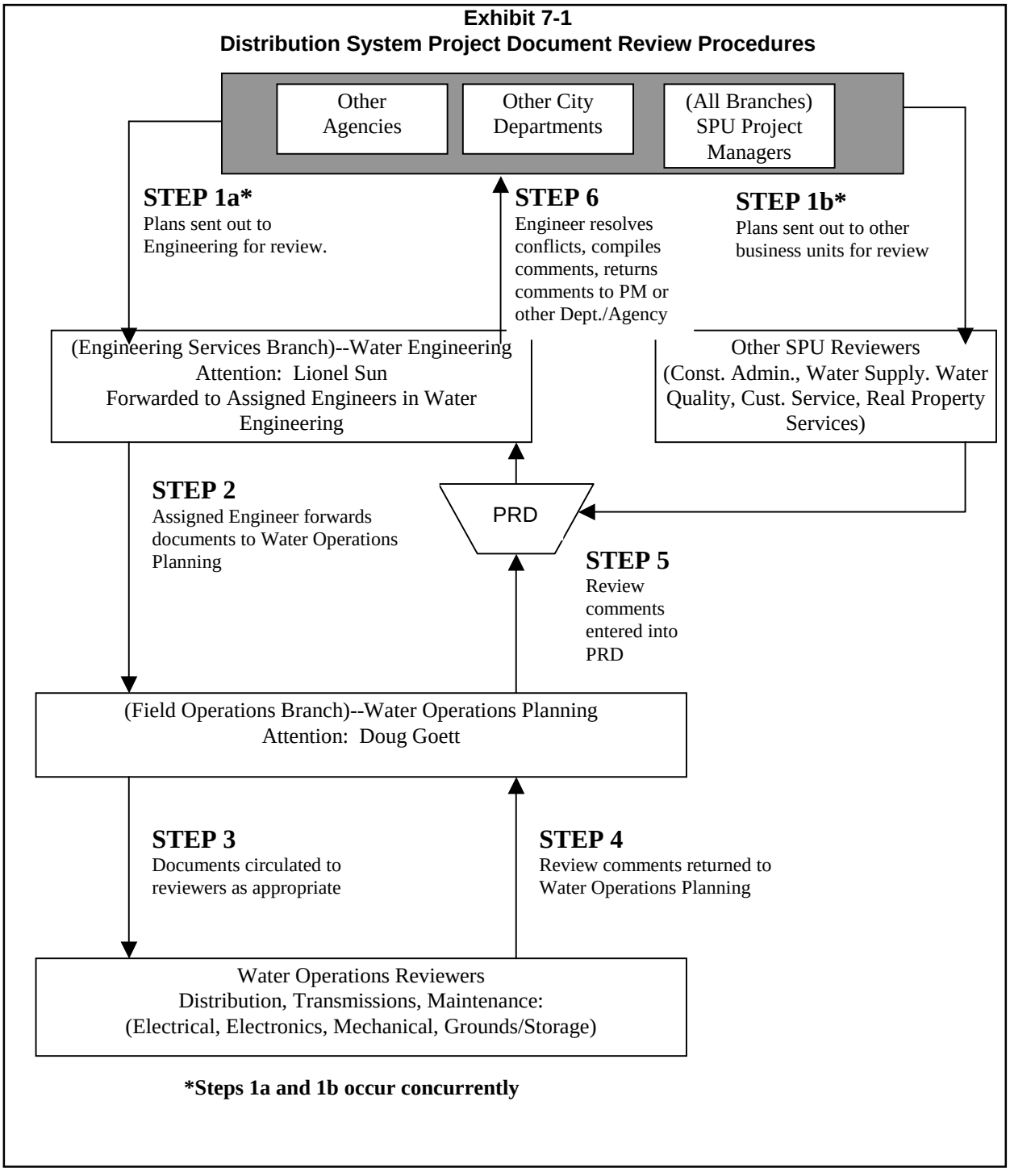
## 7.1 Project Review Procedures

All improvements and modifications to the water distribution system follow the Project Document Review Procedure. The distribution system Project Document Review Procedure process is presented as Exhibit 7-1. The Project Document Review Procedure is triggered at a point in the design phase when preliminary project documents are received from an external source such as a developer or other agency or at the point when internal SPU circulation of preliminary project documents occurs. This phase of the project is represented in the schematic by the shaded box at the top.

Step 1a and 1b of the Project Document Review Procedure occur concurrently and are designed to initiate project review from Engineering services and other SPU business units (see organizational chart, Exhibit 6-1). Project documents prepared within one unit of Water Engineering are routed to one of the other units for review (Step 1a) and are also routed to other appropriate non-engineering SPU reviewers (Step 1b). Similar routing for review occurs for projects which include modifications of some sort to the water distribution system. Steps 2, 3, and 4 show the SPU internal document review routing process through the Field Operations Branch. All reviews are compiled at Step 5 when comments are entered into the Plan Review Database. In Step 6, Water Engineering and Customer Service are responsible for resolution of conflicts, comment compilation including City Standards, and transmittal of materials to the SPU Project Manager and other City Departments, outside agencies, and developers. Once plans are approved, a permission letter, SPU Right-of-Way Permit, or City Street Use Permit is sent as appropriate for the project's location.

The Water Engineering Section provides engineering reviews and acts as the centralized coordinator for all project documents related to the water utility infrastructure. All review comments are recorded in the Plan Review Database (PRD) managed by Water Engineering Section.

**Exhibit 7-1**
**Distribution System Project Document Review Procedures**



## 7.2 Policies and Requirements for Outside Parties

SPU has in place established developer requirements for design and installation of extension or replacement of Seattle's water distribution system. These documents and requirements, accessible through the City of Seattle website at www.ci.seattle.wa.us/util/planning/watermain/default.htm are included as Appendix 7-A. The documents available for outside parties include:

**Developers and Property Owners**

- Application to Change SPU's Distribution System
- Hydrant Testing
- Property Owner Contract
- Standard Charges
- Surety Instrument
- Transfer of Ownership

**Engineers**

- General Notes on Plans: 4" – 12" Mains
- Selective Notes on Plans: 4" – 12" Mains

**Contractors**

- General Information
- Insurance Requirements
- Hydrant Information
- Water Quality Checklist

Outside parties alter the water distribution system and the ability to deliver water if development requires replacement or extension of existing water mains, pressure zones, etc. These changes to water supply due to development are stated on the Water Availability Certificate that is issued at the time of a building permit or land use change application. Developers must follow established requirements and procedures in both the design and installation of new water infrastructure. SPU reviews and approves the design submitted by the developer and inspects the installation by the developer's contractor. Infrastructure design is based on SPU's engineering design requirements and City Standard Specifications (Seattle, 2000a), as well as other engineering considerations.

Before a developer can begin construction, the developer is required to contract with SPU to change the water distribution system. The developer-SPU contract addresses the standard charges for plan review, easement processing if needed, construction inspection, water quality testing, connection to the existing SPU system, and any other work which

SPU performs related to the developer's project. Additionally, the developer must also provide SPU with a surety instrument. All developer plans must be submitted by the developer's engineer for SPU review and approval. Finally, the developer's contractor must conduct a preconstruction meeting with SPU staff to identify and agree upon construction start dates.

## 7.3 Design Standards

Performance Standards and Sizing Criteria are addressed in Section 3.

## 7.4 Construction Standards

The 2000 City of Seattle Standard Specifications (Seattle, 2000a) includes:

- Pipe and Fittings
- Trench Excavation
- Bedding and Backfill
- Pipe Installation
- Valves
- Hydrants
- Service Connections
- Irrigation System (Backflow Prevention)
- Water (for concrete, irrigation and hydrant use)
- Distribution Materials

***The City of Seattle has developed their own supplement to standard specifications.***

These specifications include construction materials and methods of construction. Performance standards desired and expected are reflected in the construction standards. All public and private construction within the City of Seattle public right-of-way must comply with the Standard Specifications. The 2000 City of Seattle Standard Plans (Seattle, 2000b) supplement the Standard Specifications.

Where applicable, specific standard references to professional and technical society standards (such as AWWA, APWA) have been incorporated. As standards are upgraded, there is a system in place to incorporate these updates and revisions. For the painting of the interior of water tanks, coatings are limited to those that have been certified to meet NSF standard 61.

## 7.5 Construction Certification and Follow-up Procedures

### 7.5.1 Preconstruction

SPU's construction standards, the 2000 City of Seattle Standard Specifications (Seattle, 2000a) and the 2000 Seattle Standard Plans (Seattle, 2000b), serve as the basis for all public works project contract

documents. These standards are made available to all prospective bidders along with the bid documents for each project at SPU's Engineering Records Vault bid counter. The standards are revised and supplemented in individual water distribution main project plans and specifications.

Prior to the start of a water distribution main construction project, a preconstruction meeting is held with representatives of SPU design, project management, construction, water quality, and operations staff; the contractor and subcontractors; and other involved parties, such as a developer or consulting engineer. At the preconstruction meeting, SPU's procedures for submittals, inspection, water quality control, connection(s) to the existing water system, and installation of meters are discussed.

***Submittals are required for review by SPU before mains can be installed.***

Submittals are required from the contractor for review by SPU before water distribution main installation is allowed to begin. When contractors perform their own survey, grade sheets are submitted to verify pipeline grade during construction. The contractor's proposed sources of construction materials are submitted and reviewed by SPU's Materials Testing Laboratory. Specific construction materials submittals, including shop drawings, catalog cuts, and technical data are also reviewed, as required.

### 7.5.2 Construction Inspection

SPU Construction Engineering personnel perform continuous on-site inspection during installation of water distribution mains to verify conformance with appropriate AWWA, DOH, and City of Seattle Standard Specifications. The procedures listed below are followed during inspection:

**Grade and Alignment.** Grade and alignment of the new water distribution main are verified by SPU Construction Engineering personnel. Deviations from the plan grade and alignment are noted.

**Existing Utilities.** Encounters with existing utilities, both marked and unmarked, are noted by SPU Construction Engineering personnel. Proper separation between the new water distribution main and existing utilities is ensured. In the case of encountered sanitary sewers and storm drains where sufficient separation is not available, replacement of the section of sewer/drain pipe crossing over or under the pipe with new ductile iron pipe is required.

**Trench Excavation.** Trench excavation is observed to verify sufficient depth of cover over water distribution mains (36 inches of cover for 12-inch diameter and smaller mains, as per Seattle Standard Specifications 7-10.3(5)). Extra excavation is required if unsuitable material is found at the bottom of the trench.

**Pipe Bedding and Backfill.** Proper pipe bedding is ensured by SPU Construction Engineering Personnel, in accordance with Seattle Standard Specifications 7-10.3(9). Trench backfill is also observed to conform to Seattle Standard Specifications 7-10.3(10). Unsuitable backfill material is rejected. Proper compaction of the bedding and backfill is ensured and tested by SPU Materials Laboratory personnel, or a private, certified testing firm.

***SPU conducts materials inspections before installations are made.***

**Pipe Installation.** Prior to installation of new water distribution mains, SPU Construction Engineering personnel inspect pipe and appurtenances for proper size, material, thickness class, and type of joint. Proper storage and handling of the pipe before it is placed in the trench is ensured. All standing water in the trench is directed to be removed by the contractor before the pipe is laid. Proper cutting of pipe is also observed.

All pipe bell and spigot ends are inspected for cleanliness before jointing. Proper assembly and tightening of mechanical or restrained joint systems is observed. Deflection of joints is observed to not exceed allowable limits of the type of joint.

**Thrust Restraint.** Thrust restraint measures are observed to conform with the design requirements. Thrust blocking is ensured to cover a sufficient amount of area based on pipe diameter and soil type (Seattle Standard Plans No. 330.1a&b, 331.1a&b) and be of an appropriate mix of concrete. Shackle rods, when used, are observed to be of the proper type, number, and diameter.

**Corrosion Protection.** When corrosion protection and/or electrolysis monitoring measures are specified, SPU Construction Engineering personnel observe that they are properly installed. Prior to exothermic pipe bonding, the bonding surface is observed to be clean and free of paint, primer, and other coating materials. The soundness of the welds is observed and tested with a glancing blow with a 16 ounce hammer. Joint continuity tests, when specified, are observed to meet minimum levels. Polyethylene wraps are observed to be continuous and free from tears.

**Installation of Appurtenances.** SPU Construction Engineering personnel verify proper installation of valves, hydrants, blowoffs, and other appurtenances. Proper installation of hydrant tee thrust restraint systems is observed and verified.

### 7.5.3 Pressure Testing

SPU Construction Engineering personnel perform hydrostatic pressure tests of all installed water distribution mains according to the requirements of Seattle Standard Specifications 7-11.3(11). Ductile iron water distribution mains 12 inches in diameter or smaller are tested to a pressure of 300 psi. Pipes 16 inches in diameter or larger are tested to 250 psi

unless otherwise specified. The test pressure is maintained without pumping for 15 minutes for sections of water distribution main up to 1,500 feet long. A pressure drop of not more than 15 psi, with no visible leaks, during this time is considered acceptable. In-line gate valves and hydrant valves are tested for five minutes. In-line valves are tested on each side and hydrant valves are tested on the water distribution main side only. A pressure drop of not more than 5 psi during this time, with no visible leaks, is considered acceptable. Water distribution mains not passing a pressure test are corrected and retested.

Pressure tests are recorded using a Bristol Babcock portable pressure recorder, using a 0-500 psi chart set at a 96-minute duration. Each test interval is indicated on the chart, along with whether the entire test was considered acceptable. Project information, date of test, and the name of the inspector performing the test are also recorded on the chart. Charts are maintained with project records.

### 7.5.4 Disinfection, Flushing, and Water Quality Sampling

SPU Construction Engineering personnel ensure that proper disinfection and flushing are performed and sample ports are provided during water distribution main installation. They coordinate sampling of the main with SPU Customer Service Water Quality Control staff.

***SPU has strict requirements for sanitizing new mains prior to use.***

**Disinfection.** SPU Construction Engineering personnel verify that chlorine for pipeline disinfection is applied through one of three allowed methods. In water distribution main installation, dry calcium hypochlorite (65-70 percent chlorine) is applied on a pipe-by-pipe basis in an amount sufficient to provide an initial dosage of at least 25 mg/l free chlorine. In circumstances where this is not feasible, gas chlorine or liquid sodium hypochlorite is applied as the disinfectant. The amount of chlorine required for each method for each diameter of pipe is specified in section 7-11.3(12) of the Seattle Standard Specifications.

**Flushing.** After a sufficient chlorine residual and contact time have been verified by SPU Water Quality Control personnel, the installed water distribution main is flushed. Water containing residual chlorine is dechlorinated before being released to the environment. If dry calcium hypochlorite is the method of disinfection, a flushing velocity of at least 2.5 feet per second is required. Installed water distribution mains are flushed for at least five minutes for every 150 feet of new water distribution main and at least a 30-minute minimum.

**Water Quality Sampling and Testing.** Water quality samples are collected by SPU Water Quality Control personnel at intervals of 500 lineal feet or less along a new water distribution main. Samples are analyzed by the SPU Water Quality Laboratory for total coliform.

Samples showing a presence of coliform bacteria are considered unsatisfactory and disinfection, flushing, and sampling of the distribution main is repeated (Seattle Standard Specifications 7-11.3(12)M). If samples exceed requirements for any reason other than coliform, the water distribution main is flushed and re-sampled.

**Connection to Existing Distribution System.** After satisfactory laboratory results are obtained, the installed water distribution main is connected to the existing distribution system. SPU water distribution crews make the physical connection with the aid of the contractor. SPU personnel ensure that, when possible, the total length of pipe required to connect the end of the installed water distribution main to the existing system is less than one standard pipe length of 18 feet. When this is not possible, SPU personnel require the contractor to predisinfect the connection pieces and arrange for water quality sampling of those pieces.

### 7.5.5 Procedures for Preparation and Retention of Design and Construction Drawings

Water distribution main design drawings are produced by both SPU Water Design staff and outside engineering staffs. Contract drawings are used to record bid item pay quantities, "as-built" notations and corrections, and all work added or deleted by change order. At the completion of construction, a set of "as-built" drawings is transmitted to SPU Technical Resources in the Engineering Support Division of the Engineering Services Branch for transfer to a reproducible medium. A copy is created on a storage medium and given to the SPU Engineering Records Vault, a repository of project information. All projects are assigned a unique vault plan number that is used to catalog the completed construction record drawings. Electronic design drawing files are stored by SPU Technical Resources. They are used to create contract drawings that are stamped and signed and then reproduced for advertisement and the use of the contractor and SPU Construction Engineering personnel. Corrected "as-built" record drawings are also transmitted to SPU Geographic Information Systems (GIS) personnel (Information and Technology Division, Finance and Administration Branch), who transfer the project information to the City of Seattle GIS database. Within 60 days of completion of all water distribution main projects, a *Construction Report for Public Water System Projects* is submitted to DOH, in accordance with WAC 246-290-040.